Parachutes, Gravity and Air Resistance

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(http://cdn1.kidsdiscover.com/wp-content/uploads/2014/08/Parachutte.jpg)As you've most likely taught your students, gravity is the force that exists between any two objects that have mass. Weight is a measure of the force of gravity pulling on an object. So, does that mean heavier objects will fall faster?

In about 1590, as the story goes, Galileo Galilei went to the top of the Leaning Tower of Pisa and simultaneously dropped many pairs of items, such as cannon balls, musket balls, gold, silver and wood. Each time, one object was heavier than the other, yet they otherwise had the same shape and size. They both hit the

ground at the same time! Up until then, people figured that heavier objects fell faster than light objects. But Galileo determined that gravity accelerates all objects at the same rate, regardless of their mass or composition.

Challenge kids to prove this! First use a ping pong ball and golf ball to let them see Galileo's discovery about gravity.

Use two pieces of paper for the next activity. One should be heavier, such as cardboard. Now ask them what would happen if they scrunch up just the lighter weight piece of paper and drop both at the same time from the same height. Will the heavier piece land first, or the lighter piece? After the ball demonstration, hopefully they get the answer right. Drop – lighter piece will land first.

What happened? Resistance and friction are what cause changes in acceleration. Air resistance (also called drag) slowed down the heavier piece. Drag opposes the direction that the object is moving and slows it down.

Now unfold the lighter piece and drop both at the same time from a high spot, such as a desk or ladder. They should land at about the same time.

So, regardless of weight, the more resistance/friction an object has, the slower the fall.

Finally, drop a rock and a feather that are about the same size. The heavier rock will land first. But it's not because it weighs more, as you've already proven. There is more friction between the feather and the air around it. If there were no air, the two objects would hit the ground at the same time.

To slow down a fall of an object, you will want to create more drag. That's the goal of a parachute. Feathers make better parachutes than rocks.

An early concept of a parachute was found in an anonymous manuscript from the 1470s, long before Galileo was dropping stuff off the Tower of Pisa. It wasn't the best design – the parachute is too small to offer enough resistance – but the design introduced a new concept to artist-engineers of the times. A few years later, Leonardo da Vinci sketched a similar design with better proportions of the canopy to the jumper. Most give Leonardo credit for the concept of falling safely using a "maximum drag decelerator" aka parachute.

The concept wasn't new, however. The use of air resistance to slow down a fall can be dated back to 90 B.C. According to Chinese historian Si Ma Chian, a legend described an emperor using two bamboo hats to jump off a roof and land safely on the ground. Chinese acrobats also used parachutes of some kind to perform falling stunts. There are other stories based on legends about parachutes that date long before Leonardo da Vinci's design.

By the way, don't try these stunts at home, we don't know how successful they really were.

Parachute designs continued to evolve and be tested. In 1785 Jean Pierre Blanchard made the first emergency use of a parachute after the hot air balloon he was in exploded. He also designed a foldable silk parachute. Before that, parachutes were built with a rigid frame. About a hundred years later, parachutes came with a harness and folded into a knapsack-like container.

Parachutes are used to deploy troops and support into war zones, deliver supplies and cargo, save lives, decelerate aircraft, and more recently, for the sport of skydiving. The simple concept has evolved into a masterful invention that can be steered and manipulated almost like an airplane, just by using lift, drag, and gravity.

Challenge: Build a Better Parachute

Here are instructions for a toy parachute. Your classroom can divide into groups or teams and try altering the materials and design, always using identical objects as the jumper:

1. Cut a circle out of a paper bag, plastic bag, piece of tissue, cotton cloth, silk, etc. Let them decide the size (bigger will be better)

2. Punch holes around the edge of the circle, at least four. Tissue will need some reinforcement first, a piece of tape will work.

3. Tie string to each hole. The pieces should be the same length.

4. Tie the strings together under the parachute and secure the jumper.

5. Test!

The variables are numerous in this – for one thing, the height from which the parachute is dropped: it will pick up speed before air resistance slows it down so the higher the better. Does the parachute want to rock back and forth? Maybe it needs a hole in the middle to allow air to flow through the middle. See if one of your students figures that out. Did the larger parachutes work better? Did material make any difference? Did number of strings have an impact on performance?

Hopefully this experiment and the others help your students understand and even better, get excited about gravity and air resistance!

About the author

Robin Koontz is an award-winning freelance author/illustrator/designer of a wide variety of nonfiction and fiction books, educational blogs, and magazine articles for children and young adults. Raised in Maryland and Alabama, Robin now lives with her husband in the Coast Range of western Oregon where she especially enjoys observing the wildlife on her property. You can learn more on her blog, robinkoontz.wordpress.com (http://robinkoontz.wordpress.com).